of the Taunton River.—MASSACHUSETTS: tidal shores of the Taunton River, Dighton, October 21, 1923, *Johnston & Fassett*, no. 905; tidal shores of the Taunton River, Berkeley, October 21, 1923, *Johnston & Fassett*, no. 903; tidal shores of the Three Mile River, Dighton, October 21, 1923, *Johnston & Fassett*, no. 906 (TYPE in Gray Herb.).

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THE AMPHIBIOUS GROUP OF POLYGONUM, SUBGENUS PERSICARIA.

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(*Continued from p. 129.*)

As the next advance in the study of these plants Gray[1] proposed *Polygonum Hartwrightii*, differentiating it chiefly by the spreading foliaceous rim of the ocrea, with the comments:

"Fruit unknown. I collected this almost 40 years ago at the head of Cayuga Lake [N. Y.] along with the remarkable *P. amphibium* var. *Muhlenbergii* of Meisner, which is widely distributed in North America. I saw it several years ago . . . in a high bog near the southern borders of Herkimer County, but not in flower. I have also a well developed specimen from the State collection in Michigan. Not regarding the stipules, it had been taken for one of the various puzzling varieties of *P. amphibium*, or, where the stipules were noticed, for an undeveloped condition of *P. Careyi*. But my attention having been called to it by Dr. S. Hart Wright, of Penn Yan, who finds it in open bottom land, among Carices, at Dundee, Yates County, New York, I am desirous that it should bear his name, as the real discoverer of its specific characters."

Watson[2] took up the varietal name of Meisner for *P. coccineum*, and published *P. Muhlenbergii:*

"New England to Texas and westward to Washington Territory and northern California . . . . . including most of the var. *terrestre* of American botanists. Our subterrestrial form of *P. amphibium* seems rarely if ever to correspond to the var. *terrestre* of Europe."

The same writer, in including *P. Hartwrightii* in his Botany of California, remarked that it "Varies greatly . . . approaching *P. amphibium* too closely."

Britton[3] revived for the same plant the varietal designation of

[1] Gray, Proc. Am. Acad. viii. 294 (1870).
[2] Watson, Proc. Am. Acad. xiv. 295 (1879).
[3] Britton, Trans. N. Y. Acad. Sci. viii. 73 (1889).

Michaux, as *P. emersum* (Michx.) Britton, and this name has been used by several later writers. In the sixth edition of Gray's Manual the aquatic plant corresponding to *P. natans* (Michx.) Eaton is listed as *P. amphibium* L., *P. coccineum* as *P. Muhlenbergii* Wats., and *P. Hartwrightii* is also included as a species. These three general groupings have been followed in most later American floristic works. A few years later Sheldon[1] described from Minnesota *P. rigidulum*, a plant treated in this paper as a variety of *P. coccineum*.

Further subdivision in the amphibious group is chiefly the work of Greene.[2] This writer was one of the first, and the principal modern American botanist, to advocate the elevation to generic rank of the various subordinate groupings proposed by Meisner and others, and he published the proposed species of these plants under the generic designation *Persicaria*, which seems to have been very generally used in pre-Linnean time. Greene was also most emphatic in his opinion that the European *Polygonum amphibium* L. was distinct from any American species (though characteristically not considering it necessary to record any detailed statement of the differences). His general opinions as to the amphibious group are expressed in the following excerpt:

"The view reached by myself after years of observation upon living plants both at the West and at the East is that we have a number of distinct species that are normally aquatic, and as many more that are normally terrestrial; and that our aquatic plants, at least in several instances, appear as riparian plants with wonderfully changed foliage, and that several of our normally terrestrial species do, under certain conditions, develop aquatic branches with floating foliage, this also strangely altered from the terrestrial type, yet at the same time most unlike that of the truly aquatic species in general.

I also suspect that some of the aquatic, or at all events some riparian species exist in even a third state, more strictly terrestrial, with a third set of strongly marked peculiarities of habit and foliage, and that in such third form the plants flower either very rarely or never at all."

Greene's observations thus correspond to a certain extent with those of European authors elsewhere cited, who recognize three principal adaptations of *P. amphibium*, usually referred to as the varieties *natans* Moench, *terrestre* Leers, and *maritimum* Dethard., according to occurrence in water, as emersed or terrestrial, or in an arid habitat

[1] Sheldon, Bull. Geol. Nat. Hist. Surv. Minn. ix. 14 (1894).
[2] Greene, *Certain Polygonaceous Genera*. Leaflets, i. 17–50 (1904).

such as a sand-dune. Greene also emphasized the idea that these adaptive modifications were "states or phases, not varieties, so that to give them any kind of separate rank, or to assign them names as such would be to misrepresent the facts in the case, and therefore to be unscientific." He remarked also that

"The delimitation of species will be most difficult, so long as a number of the species are known in only one of the three of their possible phases. Nevertheless, I am about to propose a very considerable number of new species: and shall found some upon the aquatic phase only, others upon a riparian state only, as well as many more upon properly terrestrial plants, In the case of these last I am the less afraid of erring, knowing as I think I do, that these are more commonly of one phase only. But in the case of the normally aquatic, I shall doubtless found aggregates . . . .

Here, then is work for many a future generation of botanists . . . . it must be begun in the field, and carried on there, patiently and persistently."

It might be remarked that this is not the only case in which Greene's labors have provided "work for many a future generation of botanists." He also declined

"To make any use or application of old varietal names, such as *terrestris*, *emersa*, *Muhlenbergii*, *natans*, and others. No one knows, and perhaps no one will ever know, what the forms or states or phases were to which the authors applied the names; and to use them ignorantly of their first application is but to make confusion worse confounded."

The "very considerable number of species" amount to 44, to which another, *P. Andrewsii*, was later added. Four—*Persicaria fluitans* (Eaton) Greene, *P. coccinea* (Muhl.) Greene, *P. rigidula* (Sheldon) Greene, and *P. Hartwrightii* (Gray) Greene, had been described by previous writers. The rest are "new." The diagnoses, discussions, and citations of specimens cover some 24 pages; no keys are given. The following excerpt indicates the general method followed:

"A diligent study of much material from almost all parts of the United States, occurring in the herbaria under the name of *Polygonum Muhlenbergii*, more recently denominated *P. emersum*, has shown that this also is an aggregate of species, some of them strongly marked, others less so. They differ from one another markedly as to leaf outline and also as to the attitude of the foliage, the leaves in some spreading away from the stem almost divaricately, but in the greater number being ascending or suberect. As to the pubescence, they exhibit not only different degrees but different kinds of hairiness; and that of the midvein beneath invariably differs from that of the

superficies of the leaf. In both the form and the indument of the bracts of the spikes one finds also another set of specific characters."

Of the total number of species 4 were described as from Greene's own collection. The number of specimens cited does not in most cases exceed three.

All Greene's species were transferred to *Polygonum* by Fedde in 1905. This transfer is obviously to be taken as merely a matter of form, based on a different conception of the genus, rather than as an expression of judgment of the validity of the species proposed.

It may be in order to interpolate at this time the views of the present writer as to the validity of these "species." Type or duplicate type material of a considerable number is available at the Gray Herbarium, and a considerable study of this material, together with comparison of the characteristics of the different types with each other and with those believed to be valid as distinctions throughout the North American Persicarias, indicates that for the most part the specimens present habital and ecological variations which are extremely inconstant when traced through a considerable amount of material. As much variation may be observed between some of the duplicate types as between many of the separate "species." Some of them may be entitled to rank as varieties, and the interblending and inconstancy of differential characteristics renders the establishment of satisfactory lines of demarcation extremely difficult. If the hypothesis of interbreeding mentioned elsewhere should prove to have any validity, this interblending, accompanied as it is by a high degree of sterility, will be further explained. In the present state of our knowledge, the writer believes that the subject of the American amphibious Persicarias may best be handled without attempting a high degree of technical subdivision upon the rather elusive characters which exist. The present treatment recognizes under *Polygonum natans* a variety based upon *Persicaria insignis* Greene, an aquatic form characterized by unusually large flowers; and under *Polygonum coccineum* a variety based primarily on *Persicaria pratincola* Greene, emended. The latter variety as here understood includes the usually strigose-hairy types of the general region of the Mississippi Valley. In this area *Polygonum natans* appears to be absent, and the material referable to *P. coccineum* shows a somewhat greater constancy and tendency to increased fertility as compared with the types occurring where the ranges of the species coincide. Another variety of *P.*

coccineum, based on *P. rigidulum* Sheldon, is also recognized. It is quite possible that further field study, undertaken with the findings of the present paper in mind, may establish other varieties.

To complete at this time the account of the Greene influence in the study of this group of plants, mention must be made of the work of Nieuwland[1] which covers some 70 pages and is the most voluminous American treatment of the amphibious group. It includes a considerable review of the pre-Linnean literature, introduced, aside from its historical value, to indicate that Linnaeus and his predecessors knew that *Polygonum amphibium* was amphibious, and that the variations between plants of water and land habitat were on that account not deemed worthy by them of varietal rank. In general the paper is an amplification of the viewpoint of Greene:

"There is no logical alternative between accepting the Linnean view of one sole species of amphibious Smartweed on the one hand, and Dr. Greene's view of a number of valid and distinct species on the other."

Greene's opinion as to the absence of *P. amphibium* in America is again asserted, and the lack of herbaceous ocrea-borders in the European species is brought out. A new subdivision of the group, said to be based on a vast amount of field study, is proposed, together with two new species and one new variety. The paper includes lengthy discussions of various phases of the species described. The following synopsis of Nieuwland's treatment, which includes the sub-headings and lists of the species, has been prepared by the present writer, The plants are treated as belonging to the genus *Persicaria*, which Nieuwland traces back to Tragus in 1531.

PERSICARIA § POTAMOCALLIS.[2] Perennial plants typically amphibious, with rose-colored to crimson flowers (never white).

Subsection I. EMERSAE. Plants never having spreading herbaceous borders to the ocreae in any of the phases.

P. amphibia (L.) S. F. Gray. *P. coccinea* (Muhl.) Greene and var. *asprella* Greene. *P. pratincola* Greene. *P. vestita* Greene. *P. grandifolia* Greene. *P. rigidula* (Sheldon) Greene. *P. lonchophylla* Greene. *P. tanaeophylla* Nieuwland.

Subsection II. HARTWRIGHTIANAE. Plants having more or less spreading herbaceous borders to the ocreae, usually in the terrestrial phase,[3] sometimes only in the terrestrial spring sterile and disappearing later.

[1] Nieuwland, *Our amphibious Persicarias.* Am. Midl. Nat. ii. 1–24, 200–247 (1911–12).

[2] Termed a subgenus in Nieuwland's summary.

[3] This sentence is taken verbatim from Nieuwland's paper.

P. caricetorum Nieuwland. *P. mesochora* Greene and var. *arenicola* Nieuwland. *P. ammophila* Greene. *P. nebrascensis* Greene. *P. Hartwrightii* (A. Gray) Greene.

Subsection III. HYDROPHILAE. Provisional.[1] Plants as far as known without any terrestrial phase, deep water aquatics with glabrous slimy foliage. Spreading borders to the ocreae always absent.

P. fluitans (Eaton) Greene. *P. canadensis* Greene.

In investigating the influence of change of habitat, Nieuwland found it difficult to force terrestrial phases to aquatic life; the terrestrial plants died, he reports, on being put in water. He also failed to germinate the seed, and never found a single indubitable seedling. In view of the fact that the more typical members of the subgenus *Persicaria* produce large quantities of viable seeds, the latter observation is of some interest. The few achenes found in the panicles of these plants often appear imperfect, but from herbarium material it cannot be asserted that they would not have properly matured in nature, though there may be a strong suspicion to that effect. Irmisch[2] witnessed the germination of the European *Polygonum amphibium*.

Other writers besides Greene, and before as well as afterward, have given some attention to the nomenclatorial rank of the variations or forms of these plants.[3] The specific identity of *Polygonum Hartwrightii* and the American floating species was reported by Bissell,[4] who noticed the occurrence of the foliage of *P. Hartwrightii*

[1] (Footnote from the original.) This subsection will probably disappear as the members become better known or their terrestrial phases found. It may be that the plants have no terrestrial phase, however, and in that case it will remain, unless another more obvious method of division seem feasible.

[2] Irmisch, Bot. Zeit. xix. 105–109 (1861).

[3] In connection with the rather derisive views of the last two writers cited regarding the mentality of those who had presumed to denote them as "varieties" it might be pointed out that the varietal concept as a whole has been rather ill-defined, and that the early writers, particularly the Europeans, in denoting these subdivisions as "varieties" or by Greek letters which have been more or less generally translated with that significance, were not thereby expressing their ignorance of the nature and relationship of the various plants in question, which they usually understood fully as well as have their latter-day critics. It has usually been the aim of systematic botany to devise a system of categories to denote entities and relations in a readily comprehensible and succinct manner. The "var." or the Greek letter has simply been used in the past as a more or less non-committal way of denoting something recognizable, yet of less rank than a species. With the adoption of the International Code with its provisions for ranks below the specific, the situation is becoming somewhat clarified, and the term "forma" is coming into usage to denote ecological responses of the type here dealt with. Certainly there is nothing unscientific in the application of appropriate terminology to denote a recognizable entity.

[4] Bissell, *Biological Relationship of Polygonum Hartwrightii to P. amphibium*, RHODORA, iv. 104, 105 (1902).

and intergrading forms on the rhizomes or stems of the previously floating plant after a drouth in Shuttle Meadow Lake, Southington, Connecticut. He drew attention to analogous conditions in *Ranunculus multifidus* and its variety *terrestris* and *Myriophyllum ambiguum* and its variety *limosum*, and proposed the designation *P. amphibium*, var. *Hartwrightii*. He also noted that the land-form was notoriously sterile, it being a rare thing to find it in fruit in that region. The name as modified by Bissell was taken up by Robinson & Fernald in the seventh edition of Gray's Manual, with the note—

"Am ambiguous plant, sometimes clearly a mere terrestrial and mostly sterile state occurring on the same rootstock as the typical form, but elsewhere seemingly a normal and well-marked fertile variety."

Blake,[1] on the basis of Bissell's observations and his own, reduced the varieties *Hartwrightii* and *terrestre* to formae. The latter designation cannot hold, since forma *terrestre* (Leers) Blake is based nomenclatorially on the terrestrial form of the European, not the American species; but it appears to the present writer correct to preserve the viewpoint of Blake and to denote as formae the obviously ecological variations of the American as well as European amphibious Persicarias.

As to *P. coccineum*, Wiegand[2] has assigned its var. *aquaticum* Willd. to lower rank as *P. Muhlenbergii* forma *natans*. While the choice of this as a formal name may be deemed very unfortunate, in view of the priority of "*natans*" as a specific for the plant named by Eaton, and as a formal name under *P. amphibium* (or varietal in the long-established European usage), it is evidently, when transferred to *P. coccineum*, to be held valid under the International Code.

[1] Blake, RHODORA XV. 164 (1913).
[2] Wiegand, RHODORA, XXVI. 3 (1924).

(To be continued)

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